of the various problems as to which postulates most nearly represent our feelings about probabilities. In the light of modern logical analysis many assumptions as to the nature of probability no longer seem obviously necessary or satisfactory. It is a matter of great importance for the development of the theory of probability on a secure logical basis that these assumptions should be carefully analyzed into their constituent parts.

The object of this paper may then be summed up in the following way. Before embarking upon the general reconsideration of the interesting and important problems of probability, it is worth while to consider in general terms the various parts of the theory, with a view to laying down the lines which any satisfactory theory must follow. The form of the present inquiry is then sufficiently explained. Probability theory consists of a set of propositions grouped together by reason of the concepts involved in them. A satisfactory treatment of the subject should give a discussion of the nature of these notions, and in particular a discussion of the nature of the entities to which they can significantly be applied. It should also give in their most fundamental form postulates involving relations between various probabilities, the propositions implicated in these probabilities being connected by various fundamental logical relations. Further, the logical implications of these postulates should be developed, so that the relations between probabilities involving propositions connected by complicated logical relations may be formulated. The postulates and their logical consequences provide the principles of probability inference. In order that these laws of inference may be applied to the problems of science, it is further necessary to examine the primitive probability propositions which are to be assumed, and to work out the results logically entailed.

DOROTHY WRINCH.

LONDON, ENGLAND.

THE FUNCTION OF GENERALIZATION.

I have a friend in one of the older sciences who has a reputation on both sides of the Atlantic for some splendid work he has done in one corner of his field. He is in many respects a broad-minded, tolerant man, especially when he is dealing with his friends or is concerned with matters outside of his province of technical investi-

gation. The other day he picked up from my desk one of three volumes of a ponderous work on the development of a certain social institution, remarking, "Such a book as that frightens me. It should never have been written." I was curious, but not altogether surprised. "Why not?" I asked; "is it not a good thing to have the knowledge so far uncovered synthesized for the general reader?" "Perhaps," he replied, "but it is bound to be full of errors; its writing should have been delayed at least one hundred years, if indeed it should ever have been undertaken. In the meantime the author might apply his energies much more to the service of science by taking some small section of his field or some one epoch and working that out as fully as the data will permit. That is the only way science will grow." I looked about the room full of books and remarked, "Perhaps you hold the same opinion about other attempts to generalize in sociology. What would you say of the works of Spencer, or of Lester F. Ward, or of this work in twelve volumes professing to give an account of the development of certain religious ceremonies and practices? Or would this one-volume work on social progress, or this on social control fare any better at your hands?" "All of them suffer from the same disease," he replied. "Think of trying to state a tenable theory of so wide a field as any one of these books attempts to cover. Without being familiar with your subject, I take it that you are only beginning to mine the ore of your data in any one of these fields. It is inconceivable that any one can write a general synthetic work in any of them which will be standard for a period of ten years, and I should suppose that there is no general agreement about the conclusions there set forth even now." "You are quite correct," I replied, "at least in regard to the tentativeness of the theories set forth. The authors themselves generally recognize this fact. Or, if they do not, the community of the sociologists do, and that is more important."

And then I tried another tack. This distinguished neighbor of mine submits, I have long suspected, to being called friend by me for other reasons than because I am a sociologist. My professional affiliations constitute a blot which he is willing to overlook in behalf of certain other considerations, one of which is that I can cheerfully take a defeat at golf and play again. Accordingly I suggested: "Possibly you would not approve of the methods of the social sciences in general, and of sociology in particular? Possibly you would not apply the sacred term 'science' to such lax disciplines as

we profess; possibly not even honor them with a place in our university curricula?" My learned friend smiled quizzically, almost as if he were on his favorite topic, and said, "I would not call sociology and the other fields of social investigation sciences, especially not in their general or theory aspects. They have not arrived at the maturity of sciences. Their methods are in process of formulation. They have yet a vast amount of concrete investigation to do in an appallingly large number of fields. When the concrete workers catch up with their generalizers and their generalizers pay heed to their investigators, the social subjects will become social sciences. In the meantime," he added smiling, "I suppose we must tolerate you—and admonish you. But, for heaven's sake, don't let your colleagues write such books as these."

All this was not entirely new to me. There are at least one hundred men in my university who feel much the same way about sociology and the social sciences. In every American university sociology hangs on by the skin of its teeth, as it were. Its teachers are required to handle classes of two or three times the average size of sections in the college, because funds are not appropriated by the budget-makers—consisting in the main of representatives of the older sciences—for the employment of enough instructors to meet the teaching requirements. And what is a little worse, we cannot secure funds for the carrying on of the investigations which our colleagues say we should make, because ours is not an exact science. We spend our days and nights running an adding machine (when we are fortunate enough to borrow one from another department) or in pounding out our own data upon the typewriter, while our friends have the clerical help and expert assistance they need. They merely "direct" their research. We must carry it on with the labor of our own hands and brains from the making of our schedules to the preparation of our manuscripts and then we may find that our petition for publication lies on file for months or even, on some occasions, for years and may finally be forgotten or denied altogether.

Something like this I said to my friend and he manifested the same polite interest which I have known him to express on other similar occasions. Really, he is not an administrator and I do not expect him to move heaven and earth—perhaps that is exaggerating the bulk of the opposition—for my beloved subject's cause. But to-day I was more interested in another matter, the direction which

our conversation had first taken and held to in the main. I knew that his views on the evils of overgeneralization were quite conventional and were shared by the general run of investigators everywhere. My friend has never written a general work, not even in a relatively special field, and he does not intend to do so. He has too much respect for his duty as a contributor to the fund of scientific knowledge. As much as I respect his achievement and the value of the highly specialized investigator, I did not think I agreed with his views on the function—or lack of function—of generalization. To make sure of his position, I asked him a question. I said, "Would you condemn the work of the generalizer in the older sciences equally as strongly as in the social sciences?" "Only in less degree," he replied; "the great need of science now and always is more concrete data, more special investigation."

"Are you not now speaking solely as a technician?" I replied; "it seems to me that unquestionably there are at least two great functions to be served by the scientist, and each is worth while, although largely for different reasons. You uphold one of these functions, that of the increasing of concrete scientific knowledge and the perfecting of methods of investigation to that end. I am wholly in sympathy with you and hope to see the day when my own subject can boast of men as distinguished in this line of service to science as those in any older field of investigation. But as a mere member of society—a citizen—I wonder if you would make the same argument as you have maintained. From this angle would you not find more use for the sociological generalizer?"

"I scarcely think so," he replied; "your writer on the history of the human family or the compiler and interpreter of all those questionable data on religious ceremonial, which I see over in the corner, misleads the public. Why cannot he be content to wait until some one or some one hundred real investigators have unearthed the facts?" "And leave the public, who are not scientists and have not the scientific method of criticism, to continue in error in the meantime?" I interposed, I fear somewhat intolerantly. "By no means," replied my friend, quickly; "the real investigators will publish their monographs and reports, and in these all the reliable data must be found anyway." "But the public does not read monographs and reports and never will," I contended; "it is only when some generalizer synthesizes these technical sources of knowledge into a connected and interpretative whole that the public will ever come to

understand the significance of the monographs of the special investigator and profit by their work. This, in my opinion, is one of the main functions of the generalizer—to interpret; to synthesize and harmonize the work of the special investigator so as to make it intelligible to and available for the general reader—the citizen, if you will. I admit your point, that in making a plausible whole out of incomplete parts the generalizer will often make mistakes and write things in his books which will not stand the test of time. But his is largely a social service, rather than a service within the narrow confines of his technical science, and it is such a great service to society that it is abundantly worth all the present error and the future correction which is necessary. The people have a right to know as much as there is to know at any particular time."

I had spoken with conviction. My friend was tolerant. He permitted himself merely to reply that he thought it better that the public should remain in ignorance of such technical questions for the time being rather than that they should be taught something which later they would have in the main to unlearn. For his part, he thought, we could go too far in muddling the brains of the average man with formulas and theories about things which did not particularly concern him anyway. Science is a matter primarily for the specialist, not for the public, and it should conform strictly to the canons of scientific procedure rather than to those of public policy, especially where public policy was little concerned.

"But," I contended, "you greatly mistake the public's attitude if you imagine they do not concern themselves with these matters. No error could be more profound than to suppose that the masses of people do not already have theories in regard to these very matters upon which these volumes which surround us are written. They are interested in everything under the sun. They have their explanation of the origin and development and functions of the family, of the meaning of ceremonial, of the sanctions of the State, the methods of fulfilling democracy, the relation of taxation to public welfare, and even of the origin of species and the biological value of war and the methods of achieving social progress even to the millennium—which unfortunately they, in common with some physicists, biologists, theosophists, Seventh-Day Adventists and the like, do not for a moment doubt will some day arrive as automatically as though it were predicated by an inherent law of nature. They do not lack for theories. The tragedy is that their theories

are so crude and uninformed by the light of scientific investigation. It is to throw this light of science upon the traditional theories of the sorts now held by the public that I would urge support of the generalizer. There is never any danger that a sincere and well-trained man in his subject, possessed of the confidence of his scientific fraternity, will fail to displace much more error in the minds of his readers by means of his general treatise than he will add to those minds. In fact, he is the chief clearing-house through which the average man must be rid of his unscientific traditional theories about a thousand and one things, and because he serves this social function he deserves the approval of society and even of the highly specialized scientific investigator."

My friend had listened to me patiently. He answered, after a moment's thought, "That may be true in the social sciences, where the average man is so intimately concerned personally with the subject-matter of those disciplines, and therefore has his erroneous or traditional theories already formulated; but I doubt if the argument applies with equal cogency to the older and better-developed sciences." "It does not apply equally, I admit," I replied, "because a long period of generalization by such men as Darwin, Huxley, Haeckel, Mendeleeff, Helmholtz, Herschel, Chamberlin, Loeb and scores of others more or less eminent has largely removed the traditional errors from the popular mind with respect to the fields of physics and chemistry and biology. The social sciences have not yet produced such a splendid exhibit of generalizers to accomplish this task for their fields. But we should, I think, welcome every generalizer of adequate training in his subject who will undertake this service to his less adequately trained fellow men. Even in the older sciences the early generalizers made many errors which have now to be corrected by further specific investigations, and as the fabric of their theories becomes rent with new knowledge until the mass of their work is discredited or supplanted, new generalizers arise to restate the knowledge since accumulated in those fields and to harmonize it with the old knowledge which remains undisputed. But for their day, the old generalizers led the masses of mankind to a new and better view of phenomena in their sciences just as do the new generalizers. No one should know better than the special investigator that ultimate truth is never attained in any one generation or by any one man, but that truth grows by small accretions and is relative to the age in which it appears. So does the general

intelligence of mankind grow and readjust itself to new worlds and times, under the guidance of the generalizers who digest the findings of the specialists and adjust them to the theories which have prevailed before."

My friend was thinking—about what he did not disclose. I am not certain that he had heard the last part of my monolog. Since he did not reply, I ventured upon a further remark: "But the social service is not the only one rendered by the generalizer, the writer of synthetic treatises. Perhaps an equally marked one is rendered to the advancement of science itself." "How do you make that out?" queried my caller, his interest returning, as much by way of shock as by conviction. "It serves scientific progress in two ways," I continued. "In the first place it does for the scientific investigator and the correlator something closely analogous to, although not identical with, what it does for the common man; it affords a point of departure for future work in the science. This is, of course, obvious enough in the case of the subsequent generalizers who construct their theories at least as much by way of critical reaction to the old treatises as by original generalization. But it is also true of the special investigator. There could be no consistent and organized progress in a branch of science except as the workers in it were able to proceed from some view-point or vision of the field as a whole. Otherwise experiment and statistical correlation would be largely random and whimsical, colored and skewed by personal interests of the investigator for the moment. Research can be planned and carried to successful completion only when the investigator, or some one who plans and directs his research, sees the larger synthetic problems of the science and its movement or development as a whole. And it matters little, I take it, whether the investigator agrees or disagrees with the general formulations of the science as expressed by the generalizer who serves as a point of departure. If the investigator finds himself in agreement he may be stimulated to work out in detailed quest of data some of the flashes of insight suggested by the generalizer. If he disagrees, his strong reaction against the conclusions of the theorist serves all the more to stimulate the researcher to the discovery of the data which will serve as the bases for correct and undisputed generalizations. Could," I asked, "modern biological science have made such rapid progress in the last fifty years if the controversial stimulus of the theoretical work of Darwin had been absent?" "No," said

my friend. "Has not the formulation of the Mendelian theory, following the investigations of Mendel and his successors, stimulated modern investigators into the field of heredity, both in behalf of the theory and in support of the theory of acquired characters, thus enriching our knowledge of this subject manifold?" "Undoubtedly," was the answer.

"A similar result was produced by the work of the sociologist Comte, and only a less marked influence was exercised by Spencer and Ward and others of their kind," I continued. "These men are no longer read with assiduity, even by scholars in the field. They have reached the stage of digest and analysis followed by interpretation and condensation for all but the specialists in the history of social theory and a few other general theorists. But the appearance of their works initiated new epochs in the study of social phenomena as well as closed old ones. They set new problems, by way of reaction from their conclusions, whether they desired it or not. And suppose," I went on, seeing that my guest was disposed to let me talk, "no generalizations had been made in physics since the days of Copernicus or Newton, but data from investigations and observations had piled up continuously, interpreted only by the lecturer and the teacher. Would not the task of sifting and putting in perspective these accumulated data now be so great as to be impossible? A careful investigator would have to spend the best years of his life sifting through this material, much as a searcher now goes through the files of the patent office looking for old models, before he would dare in conscience to begin a new investigation. The generalizer performs a valuable service to science merely by sifting through the accumulated material and discarding the rubbish while he organizes conveniently the acceptable achievement of the past.

"Nor must one neglect the public as a patron of scientific investigation. In these days of democracy, or near-democracy, no scheme for developing scientific investigation on a national scale and over a long period of time can fail to take account of the intelligent support of the voter. He will not read monographs. With the multitude of vocational and other interests which beset him, he will do well if he reads general works in a considerable number of sciences, either within college walls or later as he runs the gamut of life. He must have some understanding of the results of our work if he is to be expected to support it."

I had many other things in mind to say, but my friend was becoming restless. I should have liked to point out to him the value of the sciences for citizenship. I had in mind a particularly telling thrust, in revenge for his depreciation of the general sociologist, to be delivered by calling in question the utility of the six-year course of the modern medical school, in which he is interested, on the ground that it is very largely a process of instilling into the future physician the general conclusions or generalizations of the various medical sciences. I contented myself, however, with remarking in conclusion that, "Generalization is always valuable in all subjects. Like concrete specialized investigation, we cannot have too much of it, and we should encourage it heartily whenever any competent person is willing to undertake it. Unsatisfactory and incomplete as any one synthetic study must always be, it is a stepping-stone to something better, because it gives orientation and stimulation either to complete or to refute it. It is a point of departure."

My friend merely said: "I came by to see if you would like to try your hand at a game of golf." I took my clubs and went out with him, leaving the future of sociology and of all science except that of the nine holes, in abeyance.

L. L. BERNARD.

UNIVERSITY OF MINNESOTA.

WHAT IS ESSENTIAL IN TEACHING PHILOSOPHY?

Practically every college in the country to-day demands that its students take a certain number of courses in philosophy. If you were to ask why these courses in philosophy are demanded from a student before he can graduate, the answers would undoubtedly be vague and hazy. The probability is that no two people would agree on just why it is essential that students take these courses in philosophy.

The prime reason for demanding that students spend a certain amount of time in the study of philosophy is due without doubt to tradition and custom. During the past decades a certain amount of philosophical culture was necessary, just as a certain amount of classical culture was necessary to any one who wished to be classified as a person of culture. Our curriculum traditions have undergone a change in respect to classical languages, and their importance has decreased and is decreasing with the passing time, due largely